29 April 2003

Office of Engineering & Technology
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

REF.: ET Docket No. 03-104

SUBJECT: Notice of Inquiry, Broadband Over Power Line (BPL)

To Whom It May Concern:

I wish to submit the below Public Comments in response to the Commission's Notice of Inquiry, Broadband Over Power Line, ET Docket No. 03-104.

As an Electrical Engineering Professional, a member of the National Association of Radio and Telecommunications Engineers (NARTE)[1], and an Extra Class licensee in the Amateur Radio Service, I have serious concerns about the potential incompatibility of proposed Broadband Over Power Line (BPL) systems versus existing radio-frequency spectrum authorized users.

As outlined in the FCC news release dated 4/23/03, the proposed new BPL systems would produce modulated digital signals in the frequency range of 2 - 80MHz, transmitted over existing medium voltage power lines, with the objective of bringing Internet and other broadband applications to homes and businesses. There are several major potential technical problems with this approach that must be considered:

1. *Power line physical and technical limitations.* Power lines are of such physical dimension and design that they efficiently carry energy at the standard AC line frequency of 60Hz. At RF frequencies (the BPL-proposed 2MHz to 80MHz), power lines become very inefficient at containing the RF electromagnetic field energy, and instead act more efficiently as signal radiators than as transmission lines.

2. *Wideband nature of digital signals.* The BPL signal will be some type of modulated digital RF. This type of signal typically has an extremely wide bandwidth, directly proportional to the data rate (the higher rates, and therefore wider bandwidths, being more desirable from a strictly-BPL viewpoint). This means that the signal may occupy a very large portion (perhaps all) of the proposed 2MHz to 80MHz bandwidth.

3. *Effects on existing authorized spectrum users.* Considering Items 1 and 2 above, together with the ubiquity of power lines across the country, the radiated BPL signal could

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[1]My membership in NARTE is stated to demonstrate my professional qualifications only. The information and opinions set forth in this document are my own and in no way reflect or represent any position or view of NARTE.

provide a national blanket of interference to existing authorized users in the 2 - 80MHz spectrum. These users include, but are not limited to the following:

a. *Terrestrial television broadcast service.* This service is currently analog and would not be at all robust in tolerating such wideband digital interference as BPL may represent. Even the new digital TV broadcast signals may well suffer badly due to BPL because of the ubiquity and nearness of power lines with respect to any TV receiver. (The "nearness" aspect is particularly a problem with In-House BPL, which would bring BPL signals within inches of sensitive TV receivers.) If reception of broadcast TV (analog or digital) were affected by BPL, the future of DTV would be put in jeopardy, affecting the commercial prospects of hundreds of TV stations. It would also deprive much of the American public of a popular, free-of-charge broadcast medium.

b. *The amateur radio service.* To function, this service depends on a clean, low-noise RF environment due to the relatively low power of the transmitted signal, and resulting low level of the received signal. The affected high-frequency (HF) amateur bands are the only ones available which allow worldwide and long-distance national radio communication. This long-distance HF communication is typically used, for example, during hurricane season when a network of HF amateur operators regularly helps to protect life and property by acting as a hurricane watch. A similar service to the people and government of the USA is provided by HF amateur operations in the event of a terrorist attack or natural disaster. BPL signals will occupy the HF amateur spectrum, and being broadly radiated by power lines, may render this type of communication impossible. This could represent a threat to public safety and national security, in certain circumstances.

c. *Various aeronautical radio services.* Aeronautical communications operations, like the amateur radio service, take advantage of the unique properties of the HF radio spectrum to provide global communications to commercial and military aircraft in trans-oceanic flight. Again, like the amateur service, the low power of these transmissions will not be robust against wideband digital interference. Major commercial and national security interests could be adversely impacted.

d. *International (shortwave) broadcast services.* Again, the unique long-distance signal propagation characteristics of the HF spectrum have made international broadcasting a reality for over 70 years. And, again, the received signal levels are very low and therefore highly susceptible to interference of any kind. HF broadcasting is set to go digital in the near future using the internationally recognized DRM standard. Any harmful interference to existing analog, or future digital, international broadcast services, would destroy the commercial potential of this new technology. Loss by the American public of the ability to receive international broadcasts would deprive them of a free-of-charge, uncensored source of world news and information. It would also ruin the commercial

prospects of the 20 current FCC-licensed, privately-owned HF broadcast stations in the USA.

e. *Long-range over-the-horizon (OTH) radar services.* These various services are used for military, commercial and scientific purposes. These authorized users would also be affected by the potential wideband emissions of BPL.

4. *Potential major hazard to public health and safety.* The national power grid makes use of millions of transformers to step voltage levels up or down. These transformers not only "transform" from one voltage level to another, but also provide critical **isolation** between high and low voltage levels. For example, this isolation prevents the thousands of volts on a typical neighborhood power line from appearing at a home power outlet. It is the transformer that both provides the isolation and steps down the thousands of volts used for transmission, to the typical 120 volts seen by the consumer. As noted in Item 1, power lines are designed to carry energy at 60Hz. Power line transformers are notoriously inefficient at any frequency but 60Hz. Therefore, in order to pass an RF BPL signal along the power grid, each of these millions of transformers will need to be bypassed by some type of BPL transmission interface device. If this device were to fail, it is possible that the isolation of the transformer could be compromised. This could potentially cause thousands of volts to appear at a residential wall outlet, for example. The BPL system is to make use of so-called "medium voltage" power lines. In the power industry, "medium voltage" is 1,000 to 40,000 volts. These voltages are certainly lethal. If the power grid isolation were potentially compromised in any way by a BPL device, the results to human safety would be disastrous.

With the huge interference potential of BPL, as outlined in Items 1 through 4 above, the incidental radiation from power lines will have to be kept to an extremely low level to avoid impacting existing spectrum users. The FCC has stated that BPL could be deployed under existing Part 15 Rules. However, I believe that these rules are insufficient to protect other spectrum users. The Part 15 Rules were written to address interference generated by older technologies, such as electric motors and appliances which represent a point source of interference that operates only intermittently. Part 15 also applies to RF carrier current devices which do place RF onto power lines, but these devices have a very narrow and well-defined bandwidth, whereas BPL would not.

BPL is very different from existing devices and systems that operate under Part 15. Current Part 15 devices are generally point sources of RF that operate intermittently. By contrast, BPL is a distributed source of RF (carried on ubiquitous power lines that will radiate RF signals) and would operate continuously. Based upon these factors, BPL would require separate and unique FCC rules and regulations. A precedent for this type of regulation exists in the FCC's rules on spurious emission and RF leakage relating to cable TV systems. The similarity to BPL is obvious: Ubiquitous cables carrying RF signals over huge portions of the country, that could radiate harmful interference. The main difference, however, is one that the FCC must carefully consider: Cable TV systems use heavily shielded cables that confine RF signals, while BPL uses power lines that will effectively radiate RF signals.

In addition, the issues outlined in Item 4, and their potential impact on the safety and reliability of the national power grid, must be fully evaluated and addressed.

It is for all of the above reasons that systems similar to BPL have been tested and dropped from consideration in Japan. Like the USA, Japan is highly advanced and has some of the world's best engineering and technical personnel. Their published studies should be considered in this Inquiry.

To summarize, the above comments have described serious potential drawbacks to BPL technology, which must be adequately addressed. These concerns are in the following areas:

--Potential serious interference to existing, authorized spectrum users.
--Potential threat to the commercial viability of other spectrum users and applications.
--Potential disruption of communications essential to national security.
--Potential major concerns about the safety and reliability of the national power grid.
--Potential inadequacy of FCC Part 15 to regulate BPL.

I request that you please enter these comments into the Public Comments file of ET Docket No. 03-104, relating to Notice of Inquiry, Broadband Over Power Line.

Sincerely yours,

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